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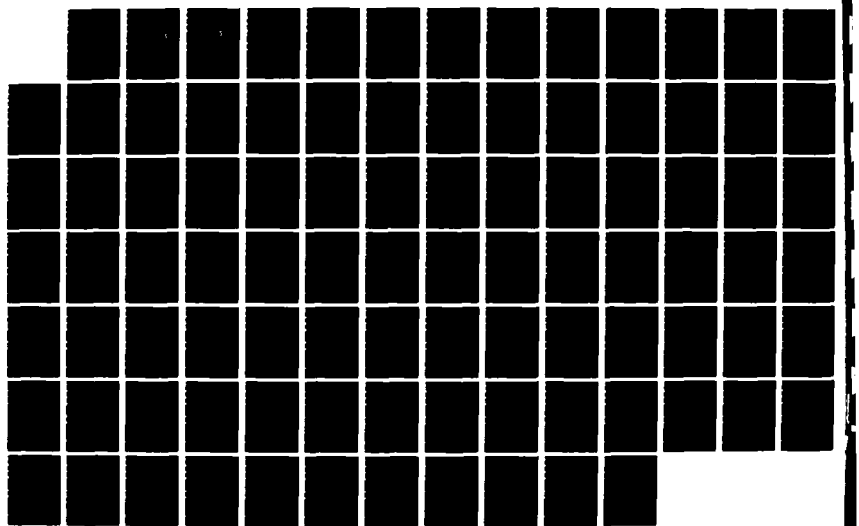

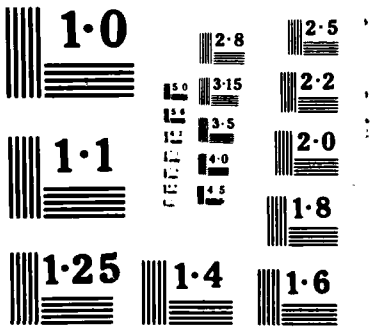
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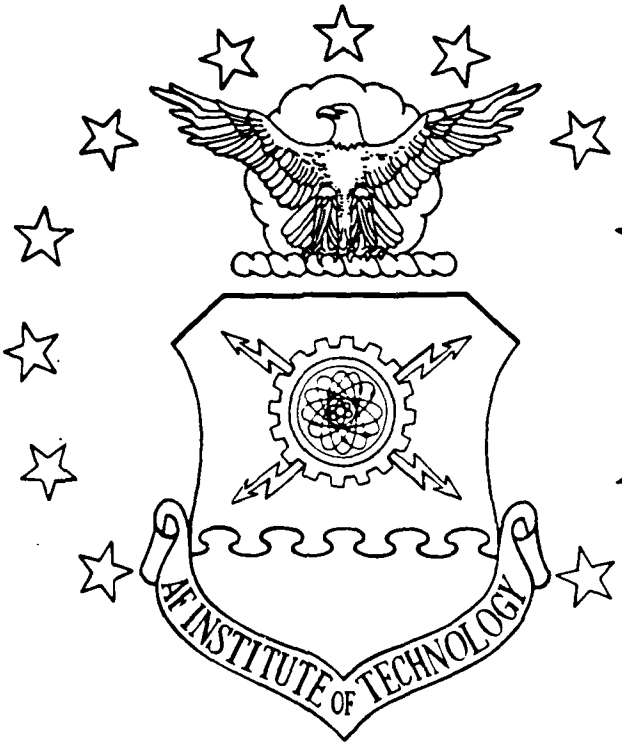

A MEASUREMENT OF CIVIL ENGINEERING CUSTOMER SATISFACTION

THESIS

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A MEASUREMENT OF CIVIL ENGINEERING CUSTOMER SATISFACTION

THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
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In Partial Fulfillment of the
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Master of Science in Engineering Management

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Abstract

The purpose of this study was to examine and quantify the perceptions of USAF Civil Engineering customers. Customer satisfaction is not a traditional measure of Civil Engineering performance evaluation, primarily because satisfaction is not easily quantified. The study had three basic objectives: (1) Determine what factors USAF Civil Engineering customers perceive as the most important when dealing with Civil Engineering. Can these factors be correlated to satisfaction? (2) Determine any differences in the perceptions of field grade officers and building managers and any differences between military and civilian building managers. (3) Determine the representativeness of a prior TAC-specific study on customer satisfaction.

In terms of the customer satisfaction model developed in this study, timeliness was the most important factor to all sample subgroups. Quality control, closeness to the customer, and communication were also significant, in descending order. While the study was successful in determining these important factors, the survey design inhibited correlation determinations.

The perceptions of the military building manager, civilian building manager, and field grade officer sample subgroups were uniform with respect to the model factors. This uniformity in perception can be inferred to exist

for all civil engineering customers. Further, the findings of a similar study conducted in TAC are representative with respect to timeliness and communication, the only two variables that could be directly compared.

The findings of the study are directly applicable to Base Civil Engineering (BCE) organizations. BCE officers should be familiar with the factors that most influence their customers' perceptions of civil engineering service.

A MEASUREMENT OF CIVIL ENGINEERING CUSTOMER SATISFACTION

I. Introduction

General Issue

Customer satisfaction has not been considered a key determinant in gauging the operational effectiveness of Base Civil Engineering (BCE) organizations, primarily because customer satisfaction is difficult to measure. There are no formal mechanisms for measuring customer satisfaction or identifying the specific factors that influence satisfaction.

Putting Customer Satisfaction in Perspective. The BCE's primary mission is to prepare the necessary assets and develop skills to sustain a global warfighting capability. While the warfighting mission must receive highest priority, the BCE is also responsible for the construction, maintenance, and repair of all base facilities to support the mission during peacetime. AFR 85-1 states, "No other base organization directly affects the living environment of every person on a base as does the BCE organization" (7:9). Further, the regulation recognizes the importance of each customer contact in terms of response and behavior. As a support organization with a community-wide

impact, Civil Engineering must be committed to satisfying its customers while meeting all mission requirements.

Existing Knowledge. Thesis research efforts by McKnight and Parker in 1983 and Singel in 1986 provide the knowledge base for studying civil engineering customer satisfaction. McKnight and Parker developed a nine-factor model of organizational effectiveness based on a survey of wing commanders, base commanders, and BCEs. While the respondents ranked professional image of the Customer Service Unit and customer satisfaction with civil engineering services high in importance, they did not recognize either characteristic as one of the five most important criteria for organizational effectiveness. These results may be a reflection of the respondents' centrality to base missions, and the important support role Civil Engineering plays in mission accomplishment. Nevertheless, McKnight and Parker included customer image as one of the nine factors of organizational effectiveness. By their definition, customer image "refers to all of the conscious actions of the organization and its members to influence the opinions of its customers" (17:79-99). McKnight and Parker limited their research to identifying the components of an organizational effectiveness model, and recommended further research to develop measurement criteria for each of the nine components, including customer image.

Singel's research objectives were to identify specific factors that impacted customer satisfaction within Tactical Air Command (TAC), and to correlate the results of his two sample groups, military building managers and field grade officers. He found that factors affecting a customer's perception of the service and the delivery of that service were related to satisfaction. Professionalism, customer service representative's attitude, and public relations influenced satisfaction the most. Interestingly, response time and quality of work were not found to be statistically significant (21:48,69-73). Singel's research had three significant limitations. First, he used a comparison between the sample groups as the basis for identifying factors that most influenced satisfaction. While such a comparison indicates sample subgroup similarities, it is not sufficient evidence to claim that these factors statistically correlate to satisfaction. Second, his sample did not include civilian building managers--an important perspective that needs to be addressed. Third, his research was limited to TAC bases in the continental U.S. (CONUS).

Specific Problem

Base Civil Engineering usually is evaluated on its resource efficiency, schedule compliance, and other easily quantifiable measurements. Customer satisfaction is the missing component, primarily because it is difficult to

measure and because it is believed to be embodied in all the measurable quantities. The purpose of this research was to identify specific factors that affect civil engineering customer satisfaction and to quantify the relative importance of each factor.

Research Objectives

Civil engineering customers were the sole focus of this research. The following investigative questions are designed to address the specific problem:

1. What factors do customers feel are the most important when dealing with civil engineering organizations? Can these factors be correlated to satisfaction?
2. How do the perceptions of field grade officers differ from those of building managers as a group? How do the perceptions of civilian building managers differ from those of military building managers?
3. How representative are Capt Singel's findings in TAC of all Air Force commands within the CONUS?

Scope and Limitations of Research

Civil Engineering operations directly affect every base organization and the living environment for all base personnel. Time and the capacity to gather data from all civil engineering customers are the two primary limitations of

this research. The scope of this study has been defined by the following conditions to overcome the natural limitations:

1. A sample was taken from active bases in the CONUS. Reserve, Air National Guard, and oversea installations are intentionally omitted to eliminate potentially confounding variables not accounted for in this study.
2. The sample was selected from three populations believed to best represent civil engineering customers: military building managers, civilian building managers, and field grade officers. Building managers are designated unit representatives who have routine contact with Civil Engineering; and field grade officers, potentially in positions of command, rely on Civil Engineering for all facility support.
3. Sample elements were randomly selected from among all units on each base.
4. Research concentrated on customer satisfaction with the Operations Branch (DEM) of Civil Engineering. DEM is the primary customer-Civil Engineering interface. This researcher realizes some of the customer perceptions are affected by the BCE organization as a whole.
5. The survey instrument focused on six broad categories of customer satisfaction: customer orientation, communication, service provider's

organization, response to complaints, timeliness, and quality of work.

6. No inferences of causality can be made about the criterion variable and the predictor variables; however, the survey design does permit inferences about the strength of association among the variables.

II. Literature Review

Service has become the focal point of American business. America is no longer dominated by manufacturing, but has become a market "dominated by industries that perform rather than produce" (1:1). In an economy where service employs 60 percent of the working Americans, it is surprising that most of the literature agrees that service quality and satisfaction are the exception, not the norm. The customers' needs, desires, and perceptions must be the central focus in a service business. Most of the literature deals with customers in manufacturing businesses; little has been written on customer satisfaction in service industries. Business analysts and writers agree that the most successful service companies treat customers as their most precious resource; however, the majority of American businesses seem to do little to measure how well they are meeting the needs and expectations of their customers. This literature review concentrates on customers in the service environment, identifying and measuring specific determinants of satisfaction, and measuring USAF Civil Engineering customer satisfaction.

Customers in the Service Environment

The customer is the most dynamic part of a service system. An explanation of the changing importance of customers, the key abstract terms,

and the different service organization models lays the foundation for understanding customer satisfaction.

The Changing Importance of Customers. The value of customers and customer perceptions has changed over the last forty years. Noted management consultant and author Thomas Peters describes the unparalleled demand for goods and services during the postwar 1940's and 1950's as an era in which quality was not as important as supply, and competition from outside sources did not exist. Demand was so great that customer satisfaction was relatively unimportant. He also describes the social and political events of the 1970's, increased foreign competition, and the recession of the early 1980's as humbling experiences for an American management style considered by many to be one of America's greatest assets. Public sector organizations suffered through the same experiences, mostly, Peters claims, because they followed the example of the industrial sector. According to Peters, "We got so tied up in our techniques, devices, and programs that we forgot about people--the people who produce the product or service and the people who consume it" (2:xv-xvii).

More recently, service providers have become aware of the importance of customer satisfaction, but most do not know how well they are meeting the expectations of their customers. In their book on service management,

Albrecht and Zemke fault American business for paying lip service to customer satisfaction with no action to support claims that "the customer is always right," or "the customer comes first" (1:47). Peters found the same fault. He polled forty company presidents at a seminar and found that all forty agreed "that long-term, total customer satisfaction (and repeat business) was clearly priority number one, the be-all and end-all. . ."; yet none of the forty had initiated a method for measuring customer satisfaction (2:101-102). Many service writers, such as Peters and Czepiel, offer the success stories of some of America's excellent companies as evidence of the importance of a successful customer orientation. Peters and Austin state that A Passion for Excellence is one of the few books on service to have a section devoted to customers (2:45). In contrast, McKnight and Parker did not find customer satisfaction to be the number one priority. In their 1983 thesis, they asked U.S. Air Force wing commanders, base commanders, and BCEs to rank the key determinants of Base Civil Engineering operational effectiveness, and found that customer satisfaction ranked 13th, and professional image ranked number 20 (17:79).

Key Definitions. Functional definitions for customers, satisfaction, and perceptions are prerequisites to measuring customer satisfaction. Peters and Austin provide the simplest definition of a customer-- one who pays the bills

(2:45). In his book on service management, Richard Normann labels the customer as both a consumer and a co-producer; that is, the customer is the recipient of the service, and, at the same time, is involved in the delivery of the service. Normann uses the term "prosumer", created by Toffler, to signify "the increasing integration between the functions of production and consumption" (18:2, 51). Interestingly, Toffler's book, The Third Wave, is an analysis of the trend toward self-service. Using Normann's terminology, base civil engineering customers are more like consumers and less like co-producers because the BCE works on facilities, not on the occupants.

Satisfaction and perceptions are intimately related in the service experience. Czepiel, and others, define satisfaction as "the result of some comparison process in which expectations are compared with that which is actually received" (6:13). Customers are most likely to be satisfied when their perception of the service matches or exceeds their expectations. Peters and Austin agree, emphasizing that perception is all there is (2:83). Customers perceive service in their own unique ways, and customers' perceptions may differ from the service provider's perceptions. Management consultant Peter Klaus says current research on customer satisfaction- dissatisfaction has shown that "consumers' decisions to choose and repeatedly use a service, to recommend it to others, and to cooperate in its performance, are enactments

of subjective perceptions" (12:21). Czepiel adds that satisfaction is a function of both the functional and performance-delivery elements of a service (6:13). For example, civil engineering customers evaluate the quality and appearance of a completed office renovation, and the way service was rendered. Additionally, Peters and Austin believe satisfaction is the customer's cumulative memory of many positive experiences, but those positive experiences can be tarnished by just one bad experience (2:90). In this study, civil engineering customer satisfaction is defined as the cumulative perception of BCE performance exceeding customer expectations.

Customers in Service Organization Models. Customer contact is the key variable in classifying service organization models. There are several models that classify service organizations, and each of them seems to be a variation of the Chase and Tansik model. Chase and Tansik developed a high-low customer contact continuum as the basis for their contingency model. This model distinguishes high-contact services as more complex because the customer is an uncertain variable. The challenge, they contend, is to match people-oriented employees with high-contact jobs, and to lay out the service facility to accommodate the customer's needs and expectations (4:1037-1042). The Chase-Tansik model is often referenced by other service management writers.

Albrecht and Zemke offer a model similar to the Chase and Tansik model, basically labeling different points on the high-low customer contact continuum. Primary service people are those who have direct, planned contact with customers. These employees should possess quality interpersonal skills. Secondary service people may have incidental contact, while support people generally do not have any customer contact (1:106). For example, Civil Engineering's Customer Service Unit technicians and certain high visibility craftsmen such as carpenters and painters would be classified as primary service people; sheet metal workers and masons would be classified as secondary service people; exterior electricians and other craftsmen that ordinarily do not have any planned customer contact would be classified as support people. Other models use different terminology, but all are centered around the degree of customer contact. Customer contact, whether plannned or unplanned, has a major impact on the customer's perception of the service.

Specific Determinants of Satisfaction

Identifying specific characteristics of service encounters that influence customer satisfaction necessarily precedes measurement. "Satisfaction," explains author and Harvard Business School professor David H. Maister, "equals perception minus expectation" (14:114). If a customer perceives that

the service received is better than expected, he is likely to be satisfied. Maister points out that expectations and perceptions are both psychological phenomena, and they do not necessarily reflect reality (14:114). While it is important to identify specific determinants of satisfaction, there is evidence against assuming that a causal relationship exists. Fiebelkorn concluded from her research with Citibank customers that a strong relationship between specific criteria and satisfaction does not imply "that doing more or performing better on specific independent variables will cause the dependent variable (overall satisfaction) to increase" (10:185). Although none of the writers claims to know and understand all the determinants of customer satisfaction, there is strong evidence that the following characteristics of the service provider are important determinants: customer orientation, communication skills, organization structure, and response to complaints.

Customer Orientation. A customer-oriented front line is the best documented determinant of customer satisfaction. University professors David Bowen and Benjamin Schneider state that while all employees have the potential to come in contact with customers, the primary service people are actually part of the service in the customer's view (3:129). They report that boundary- spanning-role (BSR) employees, also known as primary service people, serve two important functions in the service encounter:

> First, BSR employees and customers work together in the creation of many services. Specifically, services are typically produced by employees and consumed by customers simultaneously (Berry 1980) and customers frequently participate actively with employees in the creation of their own service. . . . Second, customers tend to rely upon BSR employees' behavior in forming their service evaluations because the actual service itself is often inaccessible as evidence, given its intangibility [3:128].

Bowen and Schneider's own research "confirms that customers rely upon BSR employees' behavior as partial evidence in forming their perceptions of service (how it happens) and attitudes about service" (3:128-9). Singel's research on USAF Civil Engineering customers unequivocally supports this claim. He concluded that professionalism, customer service representative's attitude, and public relations were the three criteria that contributed most significantly to customer satisfaction (21:69,74). All three of these criteria emphasize the important role of BSR employees. Moreover, Albrecht and Zemke believe customers base their perceptions on the employee's attentiveness, responsiveness, and willingness to help (1:39).

Peters emphasizes the importance of a strong customer orientation more than other service industry writers. In fact, he has devoted major sections of two books to the concept of customer orientation. Peters and Austin talk of successful companies that "smell" of customers; that is, they put the customer first, and the customer is the obsessive focus of all involved (2:45). In studying successful companies in several service industries, Peters and

Waterman found these companies were driven by "close-to-the-customer" attributes, not technology or the desire to be the low-cost producer (19:186-87). They offer IBM as a perfect example of staying close to the customer. IBM keeps its branch offices small and approachable, conducts internal and external satisfaction surveys, and holds frequent training classes to maintain a customer and market orientation (19:197).

While there is widespread agreement that a strong customer orientation influences customer satisfaction, some authors maintain that businesses are better off paying attention to technology and competition. Robert Hayes and William Abernathy criticized U.S. companies for being too customer oriented, relying on a short-term focus driven by consumer preference polls (19:197).

Communication Skills. The literature emphasizes the importance of listening and constant, open dialogue with customers. Peters and Austin are insistent about the importance of "naive" customer listening--just listening. They note that regular, in-depth debriefs with customers signal whether the perceptions of the customer match the organization's perception of the service (2:89). Peters and Waterman point out that companies strong on quality and service are the same companies that pay attention to their customers (19:196). For example, IBM makes it a point to keep in constant contact throughout the service process. They notify customers of the current status of projects, they

call customers when service trucks roll out of the driveway, and they call customers when the job is complete. The bottom line is that "live bodies at IBM are tracking the (problem) and paying close attention" (2:85). Open, frequent communication can also overcome shortcomings of the service encounter. Navy Commander John F. Conroy points out that customers of engineering projects are less likely to become frustrated by slow progress and delays if they are constantly informed of problems (5:7).

Organization Structure. There are two elements of the service provider's organization that directly impact customer satisfaction: adaptability and simplicity. Since the customer is recognized as the key variable in a service organization, Chase and Tansik stress the need for a service facility laid out to meet the needs of the customer (4:1042). Beyond the facility, Peters and Austin state that the service itself must be adapted to meet a specific customer's need. This adaptability may simply be manifested in human, "eyeball-to-eyeball" contact (2:106). Colonel Raymond Schwartz, Director of Engineering and Services, Strategic Air Command, contends that while regulations and policies serve an important purpose, they should not be a blockade to getting the job done and satisfying mission requirements of engineering customers (20). Albrecht and Zemke warn that "unplanned" systems seem "to operate solely for the convenience of the organization and

the employees of the system, not for delivering service or promoting service satisfaction among their clientele" (1:84).

Second, the simplicity, or complexity, of a service organization is a determinant of customer satisfaction. In their discussion on organizational design, Albrecht and Zemke state that "One of the most common symptoms of mediocrity in service is when the customer finds it necessary to run through an organizational maze to get his or her needs met" (1:44). Further, they state that customers in this situation perceive that no single person is responsible for the entire cycle of the service delivery process. This is an important point, say Albrecht and Zemke, because "The more people the customer must encounter during the delivery of the service, the less likely it is that he or she will be satisfied with the service" (1:37-39). Similarly, survey respondents in Singel's research indicated they preferred a single, responsive point of contact for answers to their inquiries.

Response to Complaints. A customer's level of satisfaction may be affected by his perceptions of how the service organization accepts and responds to complaints. During the Carter Administration, the White House commissioned Technology Assistance Research Programs, Inc. (TARP) to survey consumer complaint behavior. TARP's key findings included the following:

1. The average business never hears from 96 percent of its unhappy customers. For every complaint received, the average company in fact has 26 customers with problems, 6 of which are "serious" problems.
2. Of the customers who register a complaint, between 54 and 70 percent will do business again with the organization if their complaint is resolved. That figure goes up to a staggering 95 percent if the customer feels that the complaint was resolved quickly.
3. The average customer who has had a problem with an organization tells 9 or 10 people about it. Thirteen percent of people who have a problem with an organization recount the incident to more than 20 people.
4. Customers who have complained to an organization and had their complaints satisfactorily resolved tell an average of five people about the treatment they received [1:5-6].

Customer apathy was most often attributed to a perception that companies would not satisfactorily respond to complaints (15:164). In response to the TARP findings, many successful companies, such as Procter & Gamble and General Electric, have established service centers to field toll-free telephone complaints about their products. The purpose of the service center idea is to give customers fast, personal solutions, or promise to get answers (15:164).

USAF Civil Engineering could benefit from the TARP findings. In this writer's experience, USAF Civil Engineering customers perceive poor response to complaints. The TARP results clearly suggest that the BCE could improve the average customer satisfaction level by demonstrating a sincere concern for the customer's problem, and taking positive action to solve it quickly.

Measuring Customer Satisfaction

There are very few established methods for measuring customer satisfaction in the service industry. Since customers have not traditionally been the focus for measuring the success of service organizations, there are no standard measurement methodologies. Harvard Business School professor Christopher Lovelock attributes this knowledge gap to a preoccupation with technology and low-cost production (13:271). The limited literature discusses assessments generated by customers and assessments generated by the service organization.

Customer-Generated Assessments. Interviews and questionnaires are the two common types of customer-generated assessments. Personal and telephone interviews have long been used for product market research, but not in the service industries. British Airways conducted interviews of its passengers, with two questions in mind: what did air travelers perceive as the most important factors in their flying experiences; and how did British Airways compare to other airlines on each of these factors (1:33)?

The literature is not specific on interviewing technique. The primary concern is that interviews about service focus on the service provider-customer interface. For example, IBM corporate officers use an informal telephone interview as a spot check on customer satisfaction with

IBM service representatives (19:161). Albrecht and Zemke point out that interviewing need not be limited to customers. They recommend interviewing front line service people too, as they have a different perspective (1:171).

The questionnaire is the second approach for measuring customer satisfaction. Questionnaires can be used in conjunction with proposed satisfaction models, or they can be used in an exhaustive search for all possible determinants of satisfaction. In 1982, Fiebelkorn developed a model to measure Citibank customer service, and used a survey to identify satisfaction levels. The dependent variable, satisfaction, was

> viewed by the model as a function of (the customer's) satisfaction with from five to eight service element attributes. For example, the attributes contributing to teller service-encounter satisfaction were friendliness, competence, politeness, appearance, speed of transaction, and waiting time [10:182-3].

Teller service was only one of five satisfaction components of the model. While Fiebelkorn's model is based on transaction types, another model-based questionnaire, the Customer Service Assessment Scale (CSAS), is based on service provider attributes. CSAS focuses on timeliness, communication, enthusiasm, feedback, tailored service, supervisors, and response to complaints. Martin suggests that CSAS may be used with employees and management as well as with customers (16:82). Singel used a less-structured questionnaire to identify as many satisfaction determinants as possible.

Organization-Generated Assessments. Self-inspections, also called service audits, are the primary type of organization-generated assessments. Unlike customer-generated assessments, self-inspections and service audits are conducted before the service encounter. Wyckoff states, "Management must go beyond thinking of inspection merely as sorting out the good products and services from the bad or preventing bad products from reaching the customer" (23:83). Instead, he suggests self-inspection should be used to guage the organization's ability to deliver products and services. Martin presents the service audit as an outgrowth of Peters' idea of "management by walking around." He says the service audit should be structured to measure quality-service indicators, and should be used as positive reinforcement. Communication, supervision, gracious problem solving, and attentiveness are typical of the factors measured using a rating scale from "consistent" to "non-existent" (16:80-81).

Measuring USAF Civil Engineering Customer Satisfaction

There is a very limited amount of literature dealing with customer satisfaction in the public sector. The literature on satisfaction in service industries is focused on the private sector, where profit is the driving force. Peters, however, uses Baltimore's Mayor Schaefer and Tactical Air Command's

former commander, General Creech, as examples of individuals who demonstrate an outstanding customer orientation (2:13-14, 56-57). While commercial businesses and public sector service organizations have different goals, they both succeed by satisfying customers. In fact, Singel's research showed that USAF Civil Engineering customer satisfaction levels are governed by some of the same criteria as commercial service customers: customer-oriented front line and communication (21:69).

Present Measurement Methods. The BCE does not have a reliable method to directly measure customer satisfaction. Traditionally, Civil Engineering has largely been graded by measurements like delinquency rates (overdue job orders), scheduling success rates (work orders worked on divided by work orders scheduled), and shop productivity (hours actually worked divided by available hours). These statistics are easily retrievable from the records and are good indicators of productivity and efficiency, but none is a good indicator of customers' perceptions of service.

There are two established ways for the BCE to learn how customers perceive service. The first method is AF Form 1255. This form solicits customer opinions of completed jobs. While the concept is good, this researcher has found a poor response rate; customers either do not get the form from the craftsmen or they do not respond. The second method is

through Inspector General (IG) team visits. The IG asks randomly chosen customers for their perceptions of civil engineering support and service, and then briefs these perceptions to appropriate commanders. At best, the reliability and representativeness of both methods is questionable. Recently, the importance of customers is being recognized in USAF Civil Engineering.

Innovative Measurement Methods. The Model Installations Program (MIP) is a one-of-a-kind program that remembers the importance of the customer. In fact, this Department of Defense (DOD) program is designed to stress the importance of the installation and its people in carrying out the defense mission. Robert A. Stone, Deputy Assistant Secretary of Defense (Installations), directed the development of a set of Principles of Excellent Installations to guide the program and emphasize the role of individuals in its success. Interestingly, the first of these principles is "serve our customers." This tenet states

> We are here only to serve our customers and their families. Know our customers and their desires. Get out and talk and listen to them in their workplaces, homes, and communities. Tell the American people, the Congress, and our bosses what our customers need, using real-life stories that people can relate to. Show unjustifiable overcommitment to improving facilities and services for our customers [22:30].

The other principles, manage for excellence, pay for excellence, and foster the excellent installation approach show equal commitment to excellence in DOD.

TAC is leading the way in the Air Force by developing ways to institute Model Installations Program ideas. Foremost is the Peer Competition. Competition, TAC believes, fosters better performance. Brigadier General Goodwin, Director of Engineering and Services for TAC, says the Peers Competition is a dynamic process, and the measurement indicators are still being developed (11). The indicators must meet two criteria: they must be measurable, and they must impact customers. Despite the difficulty in measuring customer satisfaction, BGen Goodwin emphasizes the importance of including customers in performance measurement (11). Customer commitment, housing commitment, and mechanical systems are among the TAC Peers Competition indicators because they have a direct impact on customers. According to Singel, the Peers Competition divides customer commitment into four indicators: functional emergency response rate, maintenance timeliness rate, scheduling effectiveness rate, and design production rate (21:28). Singel found some form of each of these indicators to be statistically significant as "important" to customers (21:69).

Summary

Although the literature is limited, there is popular support for the importance of customers in services. Increasing emphasis on the customer

and customer satisfaction signals the need to identify and quantify the subjective elements that influence satisfaction. Although there is little empirical evidence, service writers widely agree that the service provider's customer orientation, communication skills, organization structure, and response to complaints all influence customer satisfaction.

There are no standard measurement instruments, but the literature supports the need to learn the customer's perceptions. USAF Civil Engineering needs a direct, reliable method to measure customer satisfaction. The TAC Peers Competition is a step in the right direction since it is concerned with measuring performance elements that have a direct bearing on the customer.

III. Methodology

This chapter contains a discussion of each element of the research design: the sampling plan, the survey instrument, and the statistical tests. The Sampling design controls the generality of the research results. A survey was used to gather data because it was the most cost-effective means of reaching a large, dispersed sample. The statistical tests provided the quantitative support necessary to help answer the investigative questions.

Sampling Plan

The primary objective of the sampling plan was to select a representative group of civil engineering customers. Determining the sample composition and size were the two most significant steps in developing the sampling plan.

Sample Composition. A random sample was chosen from three populations believed to best represent civil engineering customers at active USAF bases in the CONUS: military building managers, civilian building managers, and field grade officers. Building manager sample elements were systematically chosen from building manager listings. Seventy-six out of 82 active CONUS bases contacted provided usable building manager listings. An equal proportion of building managers was systematically chosen from each listing. Systematic sampling produced a random sample , and it simplified identifying specific

sample elements from a large population. Simple random sampling was used to select field grade officer sample elements from the U.S. Air Force Atlas Data Base. Both sampling methods were chosen to randomize the effects of base size, major command, and any other potentially confounding variables.

A conservative interpretation of generalizability limits the research findings to all field grade officers and building managers in the CONUS, a total of over 100,000 civil engineering customers. A more liberal interpretation of the findings is warranted due to the large and diverse population, the limited model, and the random sampling method. Based on this liberal interpretation, the results of this research were generalized to the entire base population.

Sample Size. The size of each subgroup was determined using a confidence interval approach. The formula is based on a large-sample interval for the difference in means for three populations, with population variances at least approximately known (8:328):

$$n = [4(z_{\alpha/2})^2(\sigma_1^2 + \sigma_2^2 + \sigma_3^2)] / L^2$$

where

n = sample size

$z_{\alpha/2}$ = factor of assurance for 95% confidence level = 1.96

$\sigma_1^2 = \sigma_2^2$ = variance, building manager populations = .182

σ_3^2 = variance, field grade officers = .311

L = interval length = .20

Population variances were estimated from Singel's research on similar groups (21:46-52). A total of 1457 surveys were mailed (500 military building managers, 500 civilian building managers, and 457 field grade officers) based on a calculated sample size of 250 and an estimated return rate of 50 percent.

The Survey

A mailed survey was the data collection instrument for this study. A questionnaire was the most practical and economical way to reach a widely dispersed sample of the population in a short period of time. Also, the survey yielded a direct measurement of the unobservable phenomenon of customer satisfaction. This survey was designed to overcome, or limit the impact of, criticisms of surveys. Roger Dominowski, author of Research Methods, describes surveys as self-reports that might be inaccurate due to respondent "failures of memory, unwillingness to provide accurate information, biases due to the manner in which the survey is taken, and inadequate self-knowledge" (9:183). Because this survey solicited civil engineering customers' general impressions, it did not require a detailed memory or technical knowledge. Also, each question was written in a neutral fashion to limit biasing.

Satisfaction Model. A customer satisfaction model was developed to structure the questionnaire. Based on Singel's exhaustive search for factors

that influence customer satisfaction and other current service literature, the model shown in Figure 1 includes six broad categories of satisfaction determinants. Responses to questions related to timeliness, customer orientation, communication, the provider's organization, response to complaints, and quality of work were used to describe the relationship between each of the factors and the criterion variable, satisfaction.

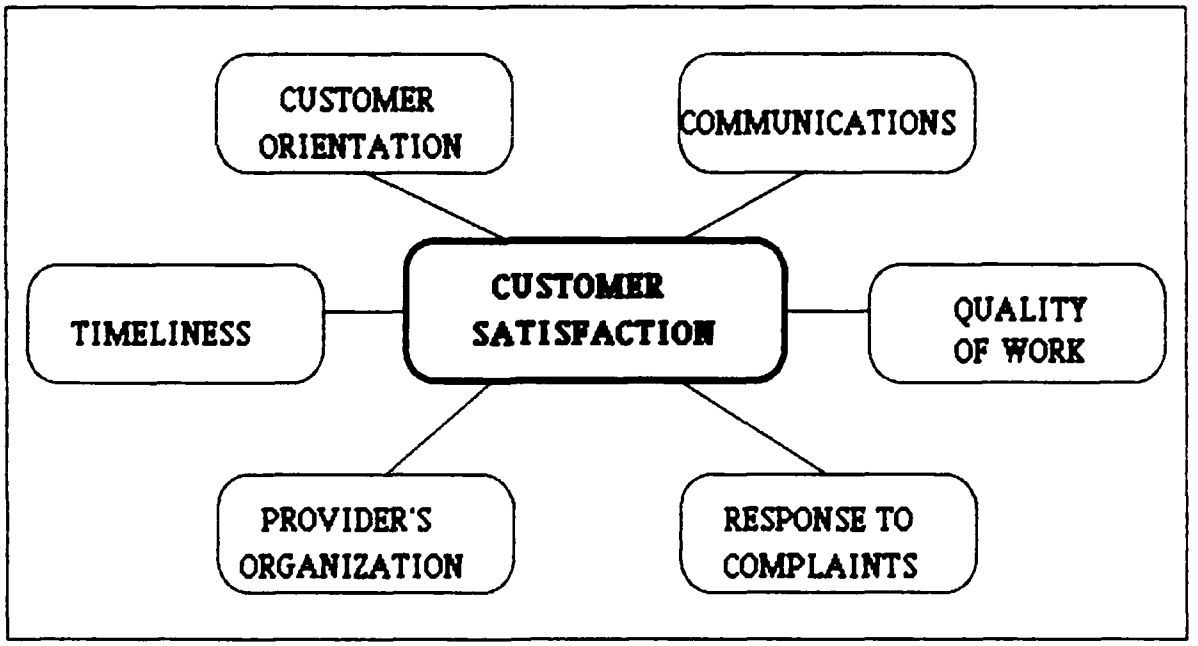

Figure 1. Customer Satisfaction Model Factors

Survey Sections. A five-part survey was used to obtain sufficient data to help answer the investigative questions. The complete survey is included in the Appendix. The first part of the survey was used to gather demographic

data on the survey respondents. Demographic data is considered to be nominal level data; therefore, it can only be divided into mutually exclusive categories (9: 46). Responses to the demographic questions were used to categorize the respondents by position and tenure for higher level data analysis.

The second part of the survey was a series of questions believed to be related to each of the six broad categories of customer satisfaction determinants. Respondents rated the level of importance of each question on a five-point Likert scale. A liberal view of measurement scales permitted this data to be classified as interval level data. Dominowski describes interval scale data as having order and equal distance between possible responses. Further, he says there is considerable debate over the validity of this claim in many research situations, but liberal interpretations do not seem to lead to serious errors (9: 47-48).

The third part of the survey was used to develop a customer satisfaction construct needed for calculating correlations, performing regression tests, and conducting discriminant analysis. Again, the responses were assumed to be interval level data.

The fourth part of the survey asked respondents to rank order a list of factors believed to impact customer satisfaction. Data from this section was

subjectively compared to the descriptive statistics calculated from the second part of the survey. This rank-ordered data was considered to be ordinal level data. Dominowski says ordinal level data has the property of order, but not necessarily equal distances between the rankings (9: 46-47). Parametric statistics cannot be applied to ordinal level data. In this case, the data was used only for subjective comparisons.

The final part of the survey allowed respondents to comment on any aspect of customer satisfaction they believed was not addressed by the survey.

Survey Pretest. Checks with thesis advisor and randomly selected peers identified problems with survey instructions, clarity, and intended purpose.

Statistical Tests

Statistical tests were used to help answer the specific research objectives. Statistical analysis provided a solid basis for conclusions about civil engineering customer satisfaction, within the survey population and across the base population.

Investigative Question 1.

What factors do customers feel are the most important when dealing with civil engineering? Can these factors be correlated to satisfaction?

Analysis was limited to the six factors presented in the customer satisfaction model. First, aggregate reliability coefficients were calculated for each of the six model factors. The reliability coefficients provided an indication of the internal consistency of each question and each model factor. Next, an aggregate correlation matrix was calculated to examine the intercorrelations of the model factors and the relationship of each factor with the criterion variable. The correlations of each factor with the criterion variable were poor, indicating that there was no linear relationship. Correlation matrices of each sample subgroup were calculated to see if the non-linear relationships could be isolated. These sample subgroup correlation matrices were substantially the same as the aggregate matrix. Plots of each model factor against the criterion variable also indicated that no linear relationship existed.

Factor analysis was used to supplement the subjective interpretation of the aggregate correlation matrix. The factor analysis indicated that some factor components needed to be regrouped to more accurately describe the model factors. More importantly, the factor analysis showed that the individual responses actually loaded primarily on four factors, not six, as the original model posed. Figure 2 shows a new customer satisfaction model as modified by the factor analysis results.

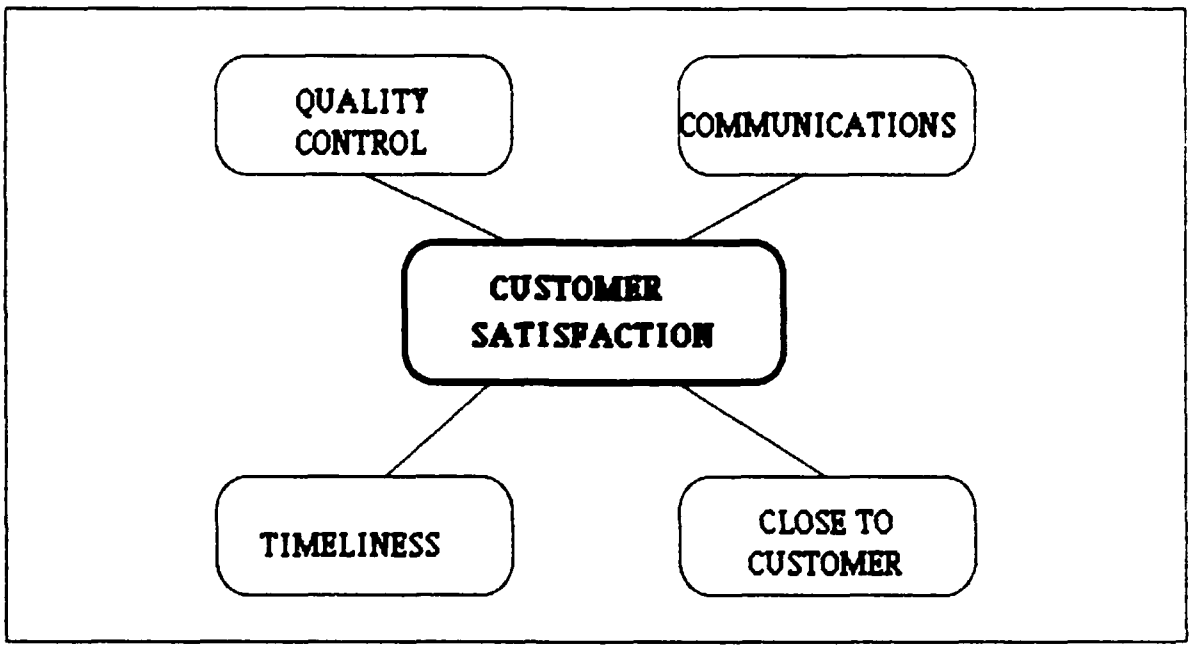

Figure 2. Modified Customer Satisfaction Model

After the new customer satisfaction model was constructed, the same reliability and correlation procedures were performed. Like the original model, the new correlation matrices did not indicate that a linear relationship existed between the model factors and the criterion variable; therefore, multiple linear regression was not used to describe the relationship of the model factors and satisfaction. Instead, discriminant analysis was used to differentiate satisfied, neutral, and dissatisfied customers. Discriminant analysis produces a linear combination of independent variables to "discriminate" between pre-defined groups. Two assumptions must be accepted to apply discriminant analysis. First, multivariate normality assumes

that predictor variable scores are independent and random. This condition is easily met by the large sample and random sampling plan. Second, a linear relationship is assumed to exist between the model factors within each discriminated group. This assumption is not as critical, since it does not increase the probability of type I errors, or errors caused by falsely rejecting the null hypothesis. The level of significance commonly used ranges from .1 to .25 for the best discrimination; this test was conducted at the .15 level.

Investigative Question 2.

How do the perceptions of senior officers differ from those of building managers as a group? How do the perceptions of civilian building managers differ from those of military building managers?

The General Linear Models (GLM) procedure tested for differences in the mean responses of each sample subgroup on each model factor and the criterion variable. The GLM procedure is basically a one-way ANOVA designed for groups of unequal size. The null hypothesis stated that there was no difference in the mean responses to a particular question; the alternate hypothesis stated that at least two of the mean responses to a particular question were unequal. This test was conducted at the .05 level of significance. Two assumptions must be accepted to apply the GLM procedure. First, all the sample elements must be independent. This condition is easily

met by the sampling method. Second, the criterion variable, satisfaction, must be from a normal distribution; however, since the sample size greatly exceeded thirty, the Central Limit Theorem asserts that this condition was met (8: 347-348).

The GLM procedure only tested for differences in mean responses between the sample subgroups, it did not identify which sample subgroups were statistically different from the rest. Tukey's procedure was used to identify specific sample subgroups with statistically different mean responses to a particular question.

Investigative Question 3.

How representative are Capt Singel's findings in TAC of all Air Force commands in the CONUS?

This question was answered subjectively due to the differences in data analysis methods. Singel based his conclusions on the results of the one-way ANOVA, but this test only identified significant differences between sample group mean scores. GLM procedure results were subjectively compared to Singel's ANOVA results.

IV. Results and Analysis

This chapter contains a summary of the administrative and demographic data, the quantitative research data, and the results of the statistical tests. The administrative and demographic data are indicators of the external validity of the research effort. The research data section summarizes sample subgroup responses to Sections II, III, and IV of the survey. Finally, the results of the statistical tests are presented in a discussion of each investigative question.

Administrative and Demographic Data

The diverse sample is representative of the larger population. Overall, 976 of the 1433 deliverable surveys were completed and returned, a response rate of 68.1 percent. Only 24 surveys out of 1457 were returned undeliverable as addressed. Table 1 summarizes the response rate for each sample subgroup. Thirty-two surveys were returned with erroneous markings for the survey question used to separate subgroups; therefore, these 32 individuals are not represented in Table 1, but their responses were included in calculating the overall response rate and in aggregate statistical tests. It is important to note that, in each case, the response rate is greater than the expected 50 percent return rate; thus, the sample size determined in Chapter II is satisfied for each

TABLE 1

Sample Subgroup Response Rate

SUBGROUP	SURVEYS MAILED	SURVEYS RETURNED	RESPONSE RATE (%)
Military Building Manager	500	405	81
Civilian Building Manager	500	303	60.6
Field Grade Officer	457	236	51.6
TOTAL	1457	944	68.1

sample subgroup. The subgroup return rates indicate that response rates are representative of the respective subgroups, especially the military building manager subgroup.

Sample subgroup tenure and frequency of contact with Civil Engineering indicated that survey respondents adequately represent the larger population. A majority of the respondents has been a member of, or worked for, the Air Force for more than 10 years. In fact, over 80 percent of all respondents had over ten years of service with the Air Force, while only 7.3 percent of the respondents had less than 5 years of service. Additionally, 54.9 percent of all respondents indicated that they had direct contact with Civil Engineering at least weekly, while 25.6 percent of the respondents indicated contact less than once a month.

Quantitative Data

Simple statistics were calculated for each quantitative item on the survey. A summary of the results is presented by survey section.

Survey Section II. In this section, respondents were required to rate the importance of 36 items related to Civil Engineering. A five-point Likert scale allowed integer responses ranging from one to five. A value of one indicated the item had no importance to the respondent, and a value of five indicated the item was extremely important. Each questionnaire item was designed to be a component of a specific model factor. Table 2 shows the subgroup mean scores and standard deviations for each item. The number of respondents varied slightly within the subgroup because the SAS computer procedure used in the calculations omits missing and erroneous data.

TABLE 2

Subgroup Responses to Predictor Variables

Variable	Military Building Manager	Civilian Building Manager	Field Grade Officer
1. When requests for work are submitted, provide a reasonable estimate of when work will begin.	3.96 (.862)	4.05 (.750)	4.18 (.734)
2. Give the small jobs high priority.	2.94 (.802)	3.14 (.872)	2.83 (.753)

TABLE 2 (continued)

Variable	Military Building Manager	Civilian Building Manager	Field Grade Officer
3. Plan and schedule jobs quickly.	4.08 (.855)	4.13 (.774)	4.11 (.744)
4. Once a job is started, complete it quickly.	4.16 (.829)	4.26 (.782)	4.33 (.694)
5. Respond immediately to work status inquiries.	3.90 (.876)	4.05 (.817)	3.83 (.824)
6. Maintain a sense of urgency.	3.72 (.888)	3.72 (.915)	3.75 (.876)
7. Display a courteous and helpful attitude.	4.17 (.814)	4.21 (.800)	4.09 (.819)
8. Empathize with my problem, and treat it as an important request.	3.67 (.947)	3.84 (.867)	3.61 (.861)
9. Focus on requested work, not on accuracy of paperwork.	3.83 (.923)	3.95 (.905)	3.98 (.880)
10. Completely explain policies, procedures, and coordination requirements in advance.	3.73 (1.010)	3.72 (1.017)	3.60 (.899)
11. Provide assistance and direction for completing paperwork.	3.70 (.891)	3.58 (.941)	3.63 (.817)
12. Maintain a presentable personal appearance.	3.35 (.947)	3.23 (.858)	3.28 (.837)
13. When working in my building, keep disruptions to a minimum.	3.60 (.984)	3.92 (.934)	3.49 (.879)

TABLE 2 (continued)

Variable	Military Building Manager	Civilian Building Manager	Field Grade Officer
14. Provide periodic listings of all my work orders and their status.	3.82 (1.070)	3.89 (1.056)	3.36 (.927)
15. Listen to my problem, and try to understand it from my perspective.	3.83 (.891)	3.88 (.862)	3.64 (.834)
16. Explain the proposed job prior to starting.	3.48 (.938)	3.64 (.910)	3.48 (.869)
17. Provide adequate notification before starting work.	3.73 (.994)	3.90 (.962)	3.88 (.854)
18. Provide notification and explanation of work delays.	4.01 (.909)	4.09 (.924)	3.99 (.758)
19. Have craftsman or foreman discuss the progress of the job with me.	3.41 (.997)	3.53 (.978)	3.25 (.793)
20. Upon completion, explain the problem and what was done to solve it.	3.48 (.963)	3.50 (1.015)	3.28 (.900)
21. Follow-up to make sure the job was done satisfactorily.	3.92 (.972)	4.09 (.932)	3.91 (.887)
22. Provide more information on the CE organization and how it operates.	2.81 (1.013)	2.85 (1.070)	2.51 (.886)
23. Simplify or reduce paperwork and coordination requirements.	3.73 (1.011)	3.69 (1.019)	3.79 (.896)
24. Establish a single point of contact within CE for all communications.	3.76 (.944)	3.86 (.975)	3.56 (.948)

TABLE 2 (continued)

Variable	Military Building Manager	Civilian Building Manager	Field Grade Officer
25. Allow schedule flexibility to fix all problems once discovered.	3.67 (.850)	3.81 (.897)	3.61 (.802)
26. Eliminate the attitude "It's not my job!", or "You need to call ___!"	4.20 (1.013)	4.34 (.938)	4.29 (.838)
27. Provide a simple mechanism for customers to express a legitimate complaint.	3.87 (.887)	3.90 (.881)	3.86 (.782)
28. Offer personal attention to complaints.	3.67 (.894)	3.73 (.864)	3.64 (.826)
29. Offer reasonable explanations to complaints.	3.81 (.877)	3.86 (.854)	3.73 (.774)
30. Permit a customer to speak to the shop foreman about a specific complaint.	3.58 (1.035)	3.75 (.977)	3.31 (.883)
31. Treat complaints on completed jobs as priorities.	3.79 (.927)	3.92 (.944)	3.77 (.825)
32. Respond quickly to legitimate complaints.	4.04 (.857)	4.21 (.813)	4.12 (.724)
33. Insure that craftsmen are fully prepared to complete the job on the first visit.	3.91 (.937)	4.07 (.974)	3.89 (.908)
34. When in my facility, keep all workers productive.	3.72 (.975)	4.09 (.913)	3.78 (.822)

TABLE 2 (continued)

Variable	Military Building Manager	Civilian Building Manager	Field Grade Officer
35. Get the job done right the first time.	4.40 (.847)	4.49 (.774)	4.48 (.728)
36. Make sure finished jobs are attractive.	4.07 (.909)	4.19 (.870)	3.92 (.786)

Survey Section III. In this section, respondents were required to indicate their level of satisfaction with Civil Engineering on two questionnaire items. Again, a five-point Likert scale allowed integer responses ranging from one to five. A value of one indicated that the respondent was very dissatisfied with Civil Engineering service, and a value of 5 indicated that the respondent was very satisfied with Civil Engineering service. Table 3 shows subgroup mean scores and standard deviations for each item. The mean score of the two items combined was used to establish the criterion variable, "customer satisfaction". The scores indicate that the civilian building manager subgroup is slightly more satisfied with Civil Engineering service than the military building manager and field grade officer subgroups.

TABLE 3

Subgroup Responses to the Criterion Variable

Variable	Military Building Manager	Civilian Building Manager	Field Grade Officer
1. In general, how satisfied are you personally with civil engineering service?	3.48 (1.082)	3.48 (1.103)	3.21 (.947)
2. Overall, how satisfied are you with the service civil engineering provides to your organization?	3.44 (1.099)	3.48 (1.117)	3.23 (.985)

Survey Section IV. In this section, respondents were required to rank order the importance of seven selected items about Civil Engineering. Respondents assigned a one to the most important item, a two to the second most important item, and so on, until all seven items were ranked.

Data collected in this section served two primary purposes. First, the mean rankings of the three sample subgroups were compared. Table 4 shows that the sample subgroups compared closely on the each of the selected rank-order items. There are no strong differences among any of the subgroups. Note that timeliness and quality of workmanship were ranked highest by all three subgroups, and that the appearance of workers was ranked last by all three subgroups. These rankings also compare quite well with Singel's ranking of customer service characteristics. Although the items to be ranked were not

identical, Singel found that timeliness and competence ranked the highest, and appearance of workers ranked at the bottom (21:54).

TABLE 4

Comparison of Rank Order of Sample Subgroups

Variable	Military Building Manager	Civilian Building Manager	Field Grade Officer
1. Appearance of workforce.	7	7	7
2. Courteous and helpful customer service representatives.	4	3	5
3. Frequent communication before, during, and after the work is complete.	5	5	6
4. Ease of submitting work requests.	3	6	3
5. Timeliness of response and completion.	1	1	1
6. Getting the job done right the first time.	2	2	2
7. Acceptance and response to complaints.	6	4	4

The second purpose for calculating the rankings of the seven selected items was to support the results in Section II. The aggregate weighted mean for each item was subjectively compared to an identical, or nearly identical, questionnaire item from Section II. Table 5 shows that the pairs of ranks compare very closely, a finding that enhances the survey internal validity.

TABLE 5

Comparison of Rank Order of Aggregate Data

Variable	Rank (Section IV)	Rank (Section II)
1. Appearance of workforce.	7	7
2. Courteous and helpful customer service representatives.	4	3
3. Frequent communication before, during, and after the work is complete.	6	5
4. Ease of submitting work requests.	3	5
5. Timeliness of response and completion.	1	2
6. Getting the job done right the first time.	2	1
7. Acceptance and response to complaints.	6	4

Statistical Test Results

Statistical tests were conducted to help answer the investigative questions. Test results are presented in a discussion of each investigative question.

Investigative Question 1.

What factors do customers feel are the most important when dealing with Civil Engineering? Can these factors be correlated to satisfaction?

Analysis was limited to the six factors presented in the original model. First, reliability coefficients (alpha), based on all 976 cases, were calculated for

each model factor using the Statistical Package for the Social Sciences (SPSS) Reliability Procedure. "Reliability refers to the degree to which a measure is correlated 'with itself,'" says Dominowski, and "an acceptable internal-consistency correlation is often considered to be about +.90" (9:259). The range of alpha values shown in Table 6 indicates a moderate internal consistency for each of the model factors. The "communication" and "response to complaints" model factors showed the greatest degree of self-correlation. These higher alpha values are most likely the result of questionnaire item similarity or a respondent perception that these model factors were the most specific. Table 6 also shows how questionnaire items were grouped for each factor of the original model.

TABLE 6

Reliability Coefficients for Model Factors

Factor	Questionnaire Items	Alpha
Timeliness	Reasonable work start estimates	
	Priority to small jobs	
	Plan and schedule jobs quickly	.748
	Complete jobs quickly	
	Quick response to work status inquiries	
	Maintain a sense of urgency	

TABLE 6 (continued)

Customer Orientation	Courteous, helpful attitude	
	Empathize with problem	
	Don't focus only on paperwork	
	Explain all procedures in advance	.723
	Assistance in completing paperwork	
	Presentable personal appearance	
	Minimize disruptions in facilities	
Communication	Periodic listings of jobs and status	
	Listen to my problem	
	Explain job before starting	
	Notification before starting jobs	.860
	Notification and explanation of delays	
	Updates on work as it progresses	
	Discuss finished jobs	
	Follow-up on finished jobs	
Provider's Organization	Provide information on CE organization	
	Simplify paperwork, procedures	
	Establish single point-of-contact	.710
	Allow more schedule flexibility	
	Eliminate "It's not my job" attitude	
Response to Complaints	Simplify procedures for complaints	
	Personal attention for complaints	
	Offer reasonable explanations	.864
	Make shop foreman available	
	Treat complaints as priorities	
	Quick response to complaints	
Quality	Be prepared on the first visit to job	
	Keep workers productive in facilities	.792
	Get the job done right the first time	
	Make sure finished jobs are attractive	

Next, a correlation matrix, based on all 976 cases, was calculated using both SPSS and SAS computer procedures. First, the correlation matrix was used to determine the intercorrelations of the model factors. Table 7 shows both the coefficients of correlation and the P-values. Note that only P-values less than .05 are statistically significant. In every case, the intercorrelations between

TABLE 7

Correlation Matrix

	Time-liness	Cust. Orient.	Comm.	Prov. Org.	Resp. Compl.	Quality	Cust. Satis.
Time-liness	1.0000 P= .	.5604 P=.000	.5996 P=.000	.5268 P=.000	.5357 P=.000	.5427 P=.000	-.0478 P=.133
Cust. Orient.		1.0000 P= .	.6556 P=.000	.6186 P=.000	.6113 P=.000	.5211 P=.000	.0749 P=.019
Comm.			1.000 P= .	.6581 P=.000	.6806 P=.000	.6092 P=.000	.0132 P=.682
Prov. Org.				1.000 P= .	.6884 P=.000	.6172 P=.000	-.0258 P=.421
Resp. Compl.					1.000 P= .	.6304 P=.000	-.0372 P=.247
Quality						1.000 P= .	.0240 P=.450
Cust. Satis.							1.000 P= .

model factors are statistically significant. Simply, this result means that there is a definite relationship between the model factors. Second, and most important, the correlation matrix was used to determine the strength of the relationship between each model factor and the criterion variable, "satisfaction". Only one model factor, "customer orientation", was statistically correlated with "satisfaction". Since the correlation coefficient between "customer orientation" and "customer satisfaction" is only .0749, "customer orientation" accounts for less than 1 percent of the variance in the responses to the "satisfaction" questionnaire items. For all practical purposes, the correlation matrix indicates that there is no linear relationship between any of the model factors and the criterion variable. Correlation matrices for individual subgroups were also calculated. Since the subgroup correlation matrices were substantially the same as the aggregate matrix, the non-linear condition is not a characteristic of any one subgroup. To further support this finding, each model factor was plotted against the criterion variable on separate graphs. There was not a trend line evident on any of the plots. This apparent lack of a relationship may be a function of the questionnaire itself. First, respondents were asked to indicate the importance of a series of items in dealing with Civil Engineering, and the respondents were instructed not to treat these items as an evaluation of their local Civil Engineering organization.

Second, respondents were asked to indicate their degree of satisfaction with Civil Engineering, resulting in the "customer satisfaction" variable. The importance a given respondent assigned to one of the model factors was obviously not correlated with that respondent's satisfaction with the local Civil Engineering organization. Because of the survey design, the exact relationship between the model factors and the criterion variable cannot be determined. However, the factors that respondents indicated were the most important when dealing with Civil Engineering can be quantified using factor analysis.

Factor analysis was used to supplement the subjective interpretation of the correlation matrix and to verify and modify the model factors. The factor analysis did, in fact, indicate that some regrouping of the model factors was necessary. The analysis showed that there were only four significant factors in the customer satisfaction model. As a result, a new four-factor model was developed, and some of the original model factor components were regrouped or omitted. Table 8 shows the results of the reliability analysis repeated for the modified model. Although the new model factor names are somewhat arbitrary, it is most important to understand that there is a better relationship among the components of each factor. Essentially, the "timeliness" and "communication" factors remained unchanged. The most significant change was the addition of a new factor, "quality control", which is basically the

TABLE 8

Reliability Coefficients for Modified Model Factors

Factor	Questionnaire Items	Alpha
Timeliness	Reasonable work start estimates	
	Plan and schedule jobs quickly	.718
	Complete jobs quickly	
	Quick response to work status inquiries	
Quality Control	Establish single point-of-contact	
	Allow more schedule flexibility	
	Eliminate "It's not my job" attitude	
	Simplify procedures for complaints	
	Personal attention for complaints	
	Offer reasonable explanations	
	Make shop foreman available	.903
	Treat complaints as priorities	
	Quick response to complaints	
	Be prepared on the first visit to job	
	Keep workers productive in facilities	
	Get the job done right the first time	
	Make sure finished jobs are attractive	
Close to the Customer	Courteous, helpful attitude	
	Empathize with problem	.746
	Maintain a sense of urgency	
	Listen to my problem	
Communication	Periodic listings of jobs and status	
	Explain job before starting	
	Notification before starting jobs	
	Notification and explanation of delays	.854
	Updates on work as it progresses	
	Discuss finished jobs	
	Follow-up on finished jobs	
	Provide information on CE organization	

collection of the following factors from the original model: provider's organization, response to complaints, and quality. The .903 alpha value for this new model factor indicates a high reliability within the components.

A new correlation matrix was calculated for the modified model. Table 9 shows moderate intercorrelations between the model factors. Once again, the correlations between individual model factors and "customer satisfaction" are extermely poor. Only "timeliness" has a statistically significant correlation with "customer satisfaction", and it accounts for less than 1 percent of the explainable variance in "satisfaction".

TABLE 9

Correlation Matrix for Modified Model

	Quality Control	Commun-ication	Time-liness	Close to Customer	Cust. Satis.
Quality Control	1.000 P= .	.7092 P=.0001	.5700 P=.0001	.6388 P=.0001	-.0253 P=.4303
Commun-ication		1.000 P= .	.5548 P=.0001	.5771 P=.0001	.0140 P=.6621
Time-liness			1.000 P= .	.5427 P=.0001	-.0678 P=.0344
Close to Customer				1.000 P= .	.0489 P=.1272
Cust. Satis.					1.000 P= .

While it was not possible to correlate any of the model factors to the criterion variable, it was possible to determine which model factors were considered most important by the respondents. Table 10 shows the relative importance of each model factor. The importance ratings were determined based on the mean scores for each model factor, given in parentheses. The

TABLE 10

Model Factor Importance Rating

Variable	Aggregate	Military Building Manager	Civilian Building Manager	Field Grade Officer
Timeliness	1 (4.069)	1 (4.027)	1 (4.124)	1 (4.113)
Quality Control	2 (3.905)	2 (3.885)	2 (4.018)	2 (3.843)
Close to Customer	3 (3.825)	3 (3.825)	3 (3.913)	3 (3.774)
Communication	4 (3.581)	4 (3.581)	4 (3.687)	4 (3.458)

mean scores are based on the five-point Likert scale used in Section II of the survey. There is perfect agreement between all three subgroups. Because each model factor is made up of several components from the survey, the ratings must be interpreted somewhat cautiously. For example, "close to the

customer" was rated third in importance among the four model factors; but, one of its components, "display a courteous, helpful attitude", was rated high by all subgroups. This does not diminish the value of Table 10, it just serves as a reminder that each model factor is actually composed of several related components, each assigned a different degree of importance by the respondents. With one exception, the mean scores for "timeliness" were the only scores greater than four, an indication of the preeminence of timeliness. "Communication" was the lowest-rated model factor, even though the scores were above the Likert scale median value of three. This indicates that all the model factors were, in fact, important to the survey subgroups.

The SAS Discriminant Procedure was used to further develop an understanding of the modified customer satisfaction model. The objective of the procedure was to detect significant differences in the composite model factor score profiles of satisfied, neutral and dissatisfied civil engineering customers. Respondents were assigned to one of the following three groups based on their mean score from Section III of the survey: dissatisfied (1 - 2); neutral (2.5 - 3.5); or satisfied (4 - 5). Table 11 shows that the discriminant procedure selected "timeliness" and "close to the customer" as the only two factors that statistically differentiate satisfied, neutral, and dissatisfied customers. Variables were added in separate steps, with the most significant

variable entering first. In both steps, the value of Wilk's Lambda is very near one, a fact which means that there is virtually no separation between groups, even though both steps are marginally statistically significant. In other words, satisfied, neutral, and dissatisfied respondents all seemed to assign a similar degree of importance to the model factors.

TABLE 11

Summary of Discriminant Analysis

Step	Variables	Wilk's Lambda	Prob > F
1	Timeliness	.9901	.0080
2	Close to the Customer	.9840	.0035

Investigative Question 2.

How do the perceptions of senior officers differ from those of building managers as a group? How do the perceptions of civilian building managers differ from those of military building managers?

The SAS GLM Procedure was used to identify any significant differences in the mean responses of each sample subgroup on each model factor and the criterion variable. Instead of treating the building manager group as a whole, all tests were conducted using three separate subgroups. Additionally, Tukey's procedure identified the differing subgroups, where appropriate.

Table 12 summarizes the results of the GLM procedure and Tukey's procedure. Significant sample subgroup differences are indicated by probability values less than .05. "Timeliness" was the only variable in which the mean responses

TABLE 12

General Linear Models Procedure Results

	GLM		Tukey's Procedure
Variable	F Value	Prob > F	Differing Subgroup
Timeliness	2.74	.0653	-------
Quality Control	6.78	.0012	Civilian Building Manager
Close to Customer	3.14	.0438	Field Grade Officer Civilian Building Manager
Communication	8.12	.0003	Field Grade Officer Civilian Building Manager
Customer Satisfaction	5.41	.0046	Field Grade Officer

of the three subgroups were not significantly different. In other words, all subgroups assigned an equal degree of importance to "timeliness". The GLM procedure detected differences in the subgroups' mean responses to the other three model factors and the criterion variable. Tukey's procedure results must be cautiously interpreted for the "communication" and "close to the customer" model factors. In each case, the field grade officer subgroup and

the civilian building manager subgroup mean responses do not differ significantly from the military building manager subgroup mean responses; however, they differ from each other. Also note in Table 12 that the field grade officer subgroup mean level of satisfaction with the local Civil Engineering organization was significantly different from the building manager subgroups; in fact, the field grade officer mean was lower. The military building manager and civilian building manager subgroups differed significantly on one variable, "quality control". In all other cases, their mean variable responses were statistically equal.

Investigative Question 3.

How representative are Capt Singel's findings in TAC of all Air Force commands in the CONUS?

The results of the GLM procedure compared favorably with Singel's ANOVA results. Based on this comparison, Singel's ANOVA results are representative of all CONUS commands. Direct comparisons can be made concerning the '"timeliness" and "communication" model factors.

Singel's ANOVA results related to "timeliness" match the findings of this research. Singel's two sample subgroups, military building managers and field grade officers, agreed closely on the importance of each questionnaire item related to timeliness (21:57). The GLM results, summarized in Table 12, also

showed close agreement on the "timeliness" factor among the three subgroups.

Singel's ANOVA results concerning "communication" adequately match the findings of this research, although exact comparison is difficult. Singel found no significant differences between field grade officers and military building managers on the following communication-related questionnaire items: providing periodic listings of work requests and their status, notification of work starts, notification of work delays, and following-up on completed work (21:57-58). Although the GLM procedure identified subgroup mean score differences on the "communication" variable, Tukey's procedure showed that these differences were not significant between the military building manager and field grade officer subgroups. While there was close agreement on most of the components of the "communication" variable, there was also disagreement on two components. Specifically, Singel found significant subgroup differences on the following items related to communication: explanation of work upon completion, and providing information on the CE organization (21:58). These subgroup differences were not identified by the GLM procedure. One explanation for this deviation is that the GLM procedure considered all communication-related items as a group, whereas Singel used ANOVA to evaluate each item separately

V. Conclusions and Recommendations

Customer perceptions and satisfaction should be important to a service organization such as USAF Civil Engineering. While customer satisfaction should be a performance indicator, the established readiness and mission support performance indicators must receive highest priority. In order to make customer satisfaction a useful performance indicator, BCE officers need a reliable method to quantify and evaluate it. This research provides the basis for developing such a measurement. This chapter contains a summary of the research objectives, including both successes and shortcomings; a summary of the civil engineering customer satisfaction model; a brief comparison of the research results to the service literature; and, finally, recommendations for using the research results at base level and as the basis for further research.

Summary of the Research Objectives

Most of the stated research objectives were achieved. Foremost, this research identified the factors that customers feel are the most important when dealing with Civil Engineering. The original six-factor model was statistically refined, and the relative importance of each of the resulting four factors was determined. Additionally, a combination of discriminant analysis and the GLM procedure were used to detect any differences in military building manager,

civilian building manager, and field grade officer responses. Subgroup responses were basically uniform, indicating that the perceptions of the three subgroups did not substantially differ. Also, the results of this study were subjectively compared to Capt Singel's research on similar subgroups in TAC. Direct comparison was possible for "timeliness" and "communication". In both cases, Singel's ANOVA results compared closely with the GLM procedure results; thus, Singel's ANOVA results are representative of all CONUS commands.

The inability to correlate the model factors to customer satisfaction was the most significant shortcoming of this research. While the research design was ideal for determining which factors were important to civil engineering customers, it was not suitable for correlation determinations. Section II of the survey required respondents to indicate the importance of each questionnaire item. In order to determine the correlation of each model factor with the satisfaction construct in Section III of the survey, however, respondents would have had to indicate their level of satisfaction with each item in Section II.

Summary of the Model Factors

Conclusions about civil engineering customers' perceptions are limited to the model developed in this research. An examination of each factor based on all statistical results clarifies the significance of the model.

Timeliness. All sample subgroups indicated that "timeliness" was the most important model factor. Factor analysis confirmed the relationship of the original factor components, and there was universal agreement on the importance of "timeliness" throughout the statistical tests. For all practical purposes, there were no significant differences in the value of "timeliness", regardless of how the data were analyzed. The discriminant analysis procedure detected only a minor difference between satisfied, neutral, and dissatisfied customers, and the GLM procedure was unable to detect any respondent difference when the data were examined by subgroup. As further confirming evidence, "timeliness of response and completion" was the highest-rated item in Section IV of the survey.

Quality Control. "Quality control" is the most diverse model factor. "Quality control" was not a separate factor in the original model, its components were grouped by the factor analysis. It is basically a collection of "quality", "provider's organization", and "response to complaints" original model factors. Its high reliability coefficient signals the best component relationship among all model factors. As a whole, "quality control" was the second most important of the model factors. Discriminant analysis did not detect any difference in the importance satisfied, neutral, and dissatisfied customers assigned to "quality control". On the other hand, the GLM procedure showed that the

civilian building manager subgroup gave "quality control" slightly more importance than the other subgroups. These findings only indicate that more of the satisfied respondents were in the civilian building manager subgroup.

Because "quality control" contains three original model factors, it is difficult to label or to describe in a single statement. Accountability and effectiveness are two adequate descriptors for this variable. Several "quality control" components, such as "establish a single point-of-contact", "eliminate "It's not my job!" attitudes", and "make foremen available to answer complaints", indicate that customers want Civil Engineering to accept responsibility for decisions and be accountable to customers. Also, other components, such as "be prepared on the first visit to the job", "get the job done right the first time", "allow more schedule flexibility", and "quick response to complaints", indicate that customers form subjective perceptions of Civil Engineering effectiveness.

Close to the Customer. This factor is comprised of four components related to service providers' personal attributes. The components of this factor were also grouped by the factor analysis. The "close to the customer" label was borrowed from service management author Thomas Peters, and, in this case, it is used to describe the personal attributes that the subgroups identified as important for Civil Engineering personnel to possess.

Of the four model factors, "close to the customer" was rated third in importance by each subgroup. Its aggregate mean was 3.85 on a five-point scale, indicating that these personal attributes are, in fact, important in customer interactions with Civil Engineering. The statistical tests showed uniformity in the importance of "close to the customer" attributes. Besides "timeliness", "close to the customer" was the only factor identified by the discriminant analysis as distinguishing satisfied, neutral, and dissatisfied customers. As in the case of "timeliness", the distinction was negligible. Further, the GLM procedure did not detect any conclusive subgroup differences in the importance of the "close to the customer" responses.

Communication. The components of "communication" were collectively given the least importance among the four model factors. "Communication" ranked lower in Sections II and IV of the survey; however, its aggregate mean was 3.58, indicating an above average level of importance to all subgroups. The factor analysis and the reliability coefficient indicated that the components of "communication" were closely related both in the original and modified models.

Statistical test results on the "communication" model factor were consistent. None of the satisfied, neutral, or dissatisfied customer groups defined in discriminant analysis assigned a distinguishably different level of importance

to "communication". Also, the GLM procedure results indicated a close agreement in "communication" component responses.

Comparison to the Literature

The literature reviewed for this research emphasized the importance of the process of serving customers; survey respondents in this research placed greater emphasis on the results of Civil Engineering service. To be more specific, writers such as Peters repeatedly discussed the importance of staying "close to the customer" and of frequent, open dialogue. These attributes are a function of the service encounter itself, not necessarily the final product. Conversely, "timeliness" and "quality control" were the two most important model factors, followed by "close to the customer" and "communication", respectively. This finding indicates that USAF Civil Engineering customers place greater value on the outcome of the service rendered. One explanation for this difference in perspective is that the service writers may assume that timeliness and quality of the service are obviously important to service customers and need no mention. Since most of the literature was aimed at profit-oriented organizations, timeliness and quality may have been perceived as necessary initial conditions to satisfy customers.

Recommendations

The results of this study have relevant applications in USAF Civil Engineering. Specifically, this research provides BCE officers with some insight on their customers' perceptions and expectations. Secondly, this research serves as the basis for further research into customer satisfaction.

Base Level Use. Customer perceptions are valuable indicators of BCE performance, but they are difficult to quantify. A familiarity with the components of the modified customer satisfaction model can help BCE officers to better understand and serve their customers. First, this research confirmed the preeminence of timeliness and quality. BCE officers should recognize that customers place the greatest importance on reasonable work start dates, quick response to job status inquiries, and expeditiously planned and scheduled work. BCE officers should also recognize that customers value more than just a commitment to quality; they also value a commitment to correcting situations that do not meet standards for quality. The BCE organization must continue to improve on these more obvious factors that influence customers' perceptions.

Second, BCE organizations should focus improvements on the factors that directly impact the service encounter. The components of the "close to the customer" model factor center around the interpersonal skills of primary service people. BCE officers can influence customer perceptions by properly

staffing key contact positions such as Customer Service Unit technicians. Although "communication" was not rated as high as the other three model factors, respondents indicated that constant, open dialogue was important. Customers want to be involved and updated on the progress of jobs as they flow through the Civil Engineering system.

Continued Research. Additional research is required to establish the exact relationship between the model factors and customer satisfaction. This research is actually the second part of a three-part investigation. First, Capt Singel conducted an exhaustive search for satisfaction determinants. Based on a refinement of Singel's findings, the customer satisfaction model presented in this research identified the factors customers feel are most important when dealing with Civil Engineering. Next, the correlation of each model factor with satisfaction must be determined. This correlation can only be determined by comparing a direct measurement of a customer's level of satisfaction on each model factor with a direct measurement of that customer's overall level of satisfaction with civil engineering services. The following specific recommendations should be valuable to future research efforts:

1. Use the modified model to focus the study.
2. Directly measure satisfaction on each factor component using a scale similar to the scale in Section III.

3. Directly measure overall satisfaction, as in Section III, for use in regression testing.

4. Use regression to verify the order of importance of model factors and to establish model factor correlations to satisfaction.

Appendix: Civil Engineering Customer Satisfaction Survey

Section I. General information. Select the answer that best describes your current position at your base.

1. What is your rank/grade?
   1. Major through Colonel
   2. Second Lieutenant through Captain
   3. Master Sergeant through Chief Master Sergeant
   4. Airman through Technical Sergeant
   5. WG-1 through WG-9
   6. WG-10 or higher
   7. GS-1 through GS-9
   8. GS-10 or higher
   9. other

2. How long have you been a member of, or worked for, the Air Force?
   1. 0-5 years
   2. 6-10 years
   3. 11-20 years
   4. more than 20 years

3. Which category applies to you?
   1. military, building manager
   2. military, non-building manager
   3. civilian, building manager
   4. civilian, non-building manager

4. Have you ever been assigned to a civil engineering squadron?
   1. yes
   2. no

5. Please estimate how often you have direct contact with the civil engineering squadron at your base?
   1. daily
   2. weekly
   3. one or two times per month
   4. less than once per month

Section II. Attitude Scale. Please evaluate each statement according to how you think it would influence your satisfaction with civil engineering. Your responses should not be an evaluation of your local civil engineering unit. Use the following rating scale when considering each item, and completely darken the appropriate oval on your answer sheet:

NO IMPORTANCE	LITTLE IMPORTANCE	AVERAGE IMPORTANCE	CONSIDERABLE IMPORTANCE	EXTREME IMPORTANCE
1	2	3	4	5

6. When requests for work are submitted, provide a reasonable estimate of when work will begin.	1	2	3	4	5
7. Give the small jobs high priority.	1	2	3	4	5
8. Plan and schedule jobs quickly.	1	2	3	4	5
9. Once a job is started, complete it quickly.	1	2	3	4	5
10. Respond immediately to work status inquiries.	1	2	3	4	5
11. Maintain a sense of urgency.	1	2	3	4	5
12. Display a courteous and helpful attitude.	1	2	3	4	5
13. Empathize with my problem, and treat it as an important request.	1	2	3	4	5
14. Focus on requested work, not on accuracy of paperwork.	1	2	3	4	5
15. Completely explain policies, procedures, and coordination requirements in advance	1	2	3	4	5
16. Provide assistance and direction for completing paperwork.	1	2	3	4	5
17. Maintain a presentable personal appearance	1	2	3	4	5

NO IMPORTANCE	LITTLE IMPORTANCE	AVERAGE IMPORTANCE	CONSIDERABLE IMPORTANCE	EXTREME IMPORTANCE
1	2	3	4	5

18. When working in my building, keep disruptions to a minimum.	1	2	3	4	5
19. Provide periodic listings of all my work orders and their status.	1	2	3	4	5
20. Listen to my problem, and try to understand it from my perspective.	1	2	3	4	5
21. Explain the proposed job prior to starting.	1	2	3	4	5
22. Provide adequate notification before starting work.	1	2	3	4	5
23. Provide notification and explanation of work delays.	1	2	3	4	5
24. Have craftsman or foreman discuss the progress of the job with me.	1	2	3	4	5
25. Upon completion, explain the problem and what was done to solve it.	1	2	3	4	5
26. Follow-up to make sure the job was done satisfactorily.	1	2	3	4	5
27 Provide more information on the CE organization and how it operates.	1	2	3	4	5
28. Simplify or reduce paperwork and coordination requirements.	1	2	3	4	5
29. Establish a single point-of-contact within CE for all communications.	1	2	3	4	5

	NO IMPORTANCE	LITTLE IMPORTANCE	AVERAGE IMPORTANCE	CONSIDERABLE IMPORTANCE	EXTREME IMPORTANCE
	1	2	3	4	5
30. Allow schedule flexibility to fix all problems once discovered.	1	2	3	4	5
31. Eliminate the attitude "It's not my job!", or "You need to call ___!"	1	2	3	4	5
32. Provide a simple mechanism for customers to express a legitimate complaint.	1	2	3	4	5
33. Offer personal attention to complaints.	1	2	3	4	5
34. Offer reasonable explanations to complaints.	1	2	3	4	5
35. Permit a customer to speak to the shop foreman about a specific complaint.	1	2	3	4	5
36. Treat complaints on completed jobs as priorities.	1	2	3	4	5
37. Respond quickly to legitimate complaints.	1	2	3	4	5
38. Insure that craftsmen are fully prepared to complete the job on the first visit.	1	2	3	4	5
39. When in my facility, keep all workers productive.	1	2	3	4	5
40. Get the job done right the first time.	1	2	3	4	5
41. Make sure finished jobs are attractive.	1	2	3	4	5

Section III Attitude Scale Please use the following scale to indicate your level of satisfaction with the civil engineering squadron at your base Completely darken the oval on your answer sheet that corresponds with your choice for each question

VERY DISSATISFIED	DISSATISFIED	NEUTRAL	SATISFIED	VERY SATISFIED
1	2	3	4	5

42 In general, how satisfied are you personally with civil engineering service? 1 2 3 4 5

43 Overall, how satisfied are you with the service civil engineering provides to your organization? 1 2 3 4 5

Section IV Rank Order Please rank the following seven items in order of importance to you when dealing with CE Place a 1 next to the most important item, a 2 next to the second most important item, a 3 next to the third most important item, and so on through number 7 Darken the oval on your answer sheet that corresponds to the ranking of each item

44 Appearance of workforce ____

45 Courteous and helpful customer service representatives ____

46 Frequent communication before, during, and after the work is complete ____

47 Ease of submitting work requests ____

48 Timeliness of response and completion ____

49 Getting the job done right the first time ____

50 Acceptance and response to complaints ____

Section V Please add any additional factors that may influence your satisfaction as a civil engineering customer, or any comments you feel may be of help to this study

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Bibliography

1 Albrecht, Karl and Ron Zemke. Service America! Homewood IL: Dow Jones-Irwin, 1985.

2 Austin, Nancy and Thomas J. Peters. A Passion for Excellence. New York: Warner Books, 1985.

3 Bowen, David E. and Benjamin Schneider. "Boundary-Spanning-Role Employees and the Service Encounter: Some Guidelines for Management and Research," The Service Encounter, edited by John A. Czepiel and others. Lexington MA: Lexington Books, 1985.

4 Chase, Richard B. and David A. Tansik. "The Customer Contact Model for Organization Design," Management Science, 29: 1037-1050 (September 1983).

5 Conroy, Cdr John F. "The Customer Expects Too Much," The Navy Civil Engineer, 7-8 (Spring 1986).

6 Czepiel, John A. and others. "Service Encounters: An Overview," The Service Encounter, edited by John A. Czepiel and others. Lexington MA: Lexington Books, 1985.

7 Department of the Air Force. Resources and Work Force Management. AFR 85-1. Washington DC: HQ USAF, 21 May 1982.

8 Devore, Jay L. Probability and Statistics for Engineering and the Sciences. Monterey CA: Brooks/Cole Publishing Company, 1982.

9 Dominowski, Roger L. Research Methods. Englewood Cliffs NJ: Prentice-Hall Inc., 1980.

10 Fiebelkorn, Sandra L. "Retail Service Encounter Satisfaction Model and Measurement," The Service Encounter, edited by John A. Czepiel and others. Lexington MA: Lexington Books, 1985.

11. Goodwin, BGen Roy, Director of Engineering and Services, Tactical Air Command. "TAC Peers Program." Address to AFIT students. Air Force Institute of Technology (AU), Wright-Patterson AFB OH, 13 November 1986.

12. Klaus, Peter J. "Quality Epiphenomenon: The Conceptual Understanding of Quality in Face-to-Face Service Encounters," The Service Encounter, edited by John A. Czepiel and others. Lexington MA: Lexington Books, 1985.

13. Lovelock, Christopher H. "Developing and Managing the Customer-Service Function in the Service Sector," The Service Encounter, edited by John A. Czepiel and others. Lexington MA: Lexington Books, 1985.

14. Maister, David H. "The Psychology of Waiting Lines," The Service Encounter, edited by John A. Czepiel and others. Lexington MA: Lexington Books, 1985.

15. "Making Service a Potent Marketing Tool," Business Week: 164-170 (11 June 1984).

16. Martin, William B. "Measuring and Improving Your Service Quality," The Cornell Hotel and Restaurant Administration Quarterly: 80-87 (May 1986).

17. McKnight, Capt Richard D. and Capt Gregory P. Parker. Development of an Organizational Effectiveness Model for Base Civil Engineering Organizations. MS thesis, LSSR 13-83. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1983 (AD-A134950).

18. Normann, Richard. Service Management: Strategy and Leadership in Service Business. Chichester England: John Wiley & Sons Ltd., 1984.

19. Peters, Thomas J. and Robert H. Waterman, Jr. In Search of Excellence. New York: Warner Books, 1982.

20. Schwartz, Col Raymond, Director of Engineering and Services, Strategic Air Command. "SAC Issues." Address to AFIT students. Air Force Institute of Technology (AU), Wright-Patterson AFB OH, 9 October 1986.

21. Singel, Kenneth R. Measurement of Civil Engineering Customer Satisfaction in Tactical Air Command: A Prototype Evaluation Program MS thesis, AFIT/GEM/DEM/86S-23. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1986 (AD-A174116).

22 Stone, Robert A. "Model Installations: Excellence in Action," The Military Engineer: 30-34 (January-February 1986)

23 Wyckoff, D Daryl. "New Tools for Achieving Service Quality," The Cornell Hotel and Restaurant Administration Quarterly 78-91 (November 1984)

Supplemental Material

1 Department of the Air Force Administrative Communications Air Force Address Directory AFR 10-4 Washington DC HQ USAF 30 June 1986

2 Emory, C William Business Research Methods (Revised Edition) Homewood IL Richard D Irwin Inc, 1980

3 "Guide to USAF Bases," Air Force Magazine 69 162-171 (May 1986)

4 Neter John and William Wasserman Applied Linear Statistical Models Homewood IL Richard D Irwin Inc, 1974

5 SAS Institute Inc SAS User's Guide Basics (Version 5 Edition) Cary NC SAS Institute Inc, 1985

6 SAS Institute Inc SAS User's Guide Statistics (Version 5 Edition) Cary NC SAS Institute Inc, 1985

7 SPSS Inc SPSS[X] User's Guide (Second Edition) New York McGraw-Hill Book Company 1986

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BLOCK 19: ABSTRACT

The purpose of this study was to examine and quantify the perceptions of USAF Civil Engineering customers. Customer satisfaction is not a traditional measure of Civil Engineering performance evaluation, primarily because satisfaction is not easily quantified. The study had three basic objectives: (1) Determine what factors USAF Civil Engineering customers perceive as the most important when dealing with Civil Engineering. Can these factors be correlated to satisfaction? (2) Determine any differences in the perceptions of field grade officers and building managers and any differences between military and civilian building managers. (3) Determine the representativeness of a previous TAC-specific study on customer satisfaction.

In terms of the customer satisfaction model developed in this study, timeliness was the most important factor to all sample subgroups. Quality control, closeness to the customer, and communication were also significant, in descending order. While the study was successful in determining these important factors, the survey design inhibited correlation determinations.

The perceptions of the military building manager, civilian building manager, and field grade officer sample subgroups were uniform with respect to the model factors. This uniformity in perception can be inferred to exist for all civil engineering customers. Further, the findings of a similar study conducted in TAC are representative with respect to timeliness and communication, the only two variables that could be directly compared.

The findings of the study are directly applicable to Base Civil Engineering (BCE) organizations. BCE officers should be familiar with the factors that most influence their customers' perceptions of civil engineering service.

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